

# Arms races, arms control, and conflict analysis

Contributions from Peace Science  
and Peace Economics

WALTER ISARD

*Cornell University*

*Written with the assistance of*

CHRISTINE SMITH

*and*

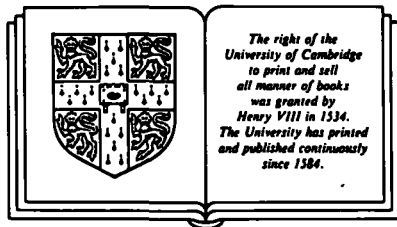
CHARLES H. ANDERTON

YASUSHI ASAMI

JAMES P. BENNETT

BRUCE BURTON

WILLIAM DEAN



CAMBRIDGE UNIVERSITY PRESS

*New York New Rochelle Melbourne Sydney*

---

# Contents

<i>List of illustrations</i>	<i>page xv</i>
<i>List of tables</i>	xviii
<i>Preface</i>	xxi
<i>Acknowledgments</i>	xxiv
<b>1 Introduction and overview</b>	<b>1</b>
1.1 The structure of the book	1
1.2 The nature of Peace Science	7
References	13
<b>Part I <i>Basic framework and set of analyses</i></b>	<b>15</b>
<b>2 A survey of arms race models</b>	<b>17</b>
2.1 Introduction	17
2.2 The classic Richardson model and key extensions	20
2.3 The effects of resource constraints and linkage to the domestic economy	23
2.4 Arms, security, and the maximization of national welfare	25
2.5 Concepts and types of strategy in arms race models	29
2.6 Races with conventional and strategic weapons	42
2.7 The effects on races of asymmetry, uncertainty, technology, international tensions, and key psychological factors	43
2.8 Organizational politics and the determination of the arms budget	51
2.9 The import of domestic political economy factors	54

viii	Contents	
2.10	Defense spending and alliances in an $n$ -nation system	57
2.11	Arms races and the operation and functioning of the world system	60
2.12	Concluding remarks	68
	References and additional bibliography	68
<b>3</b>	<b>Individual and group behavior: noncrisis situation</b>	<b>86</b>
3.1	Introduction and the general setting	86
3.2	Attitude as a basic variable	87
3.2.1	<i>The 100 percent conservative</i>	91
3.2.2	<i>The expected payoff calculator</i>	92
3.2.3	<i>The 100 percent pessimist, the 100 percent optimist, and the middle-of-the-road individual</i>	92
3.2.4	<i>The equiprobable expected payoff calculator</i>	93
3.2.5	<i>The utility maximizer</i>	93
3.3	Interdependent decision making	94
3.4	A cognitive science approach to decision making	105
3.5	Concluding remarks	114
	Appendixes	114
3.A	<i>Behavior associated with other types of attitude</i>	114
3.B	<i>The relevance of game theory</i>	116
	References	119
<b>4</b>	<b>A more formal cognitive framework for individual and group behavior</b>	<b>121</b>
4.1	Introduction	121
4.2	Behavior of the individual as a decision-making unit	122
4.2.1	<i>The action space of the individual</i>	122
4.2.2	<i>The individual as a perceiver</i>	123
4.2.3	<i>The individual as a believer and knower</i>	127
4.2.4	<i>The individual as a goal setter (aspirer)</i>	131
4.2.5	<i>The individual as a decision maker (chooser of an action or strategy)</i>	131
4.2.6	<i>The individual as a learner</i>	134
4.2.7	<i>The individual as a relocator (mover)</i>	135
4.3	A formal cognitive framework for understanding the group's behavior	137
4.3.1	<i>The action space of the group</i>	144
4.3.2	<i>The group as a perceiver</i>	144
4.3.3	<i>The group as a believer and knower</i>	145
4.3.4	<i>The group as an aspirer or a target (goal) setter</i>	148
4.3.5	<i>The group as a decision maker (chooser of an action or strategy)</i>	148
4.3.6	<i>The group as a learner</i>	149
4.3.7	<i>The group as a relocator</i>	150

Contents	ix
4.4 Concluding remarks	152
References	153
<b>5 Decision-making behavior under major psychological stress and crisis conditions</b>	<b>155</b>
5.1 Introductory remarks	155
5.2 Some preliminary remarks on Janis and Mann	156
5.3 Some preliminary formal structure	157
5.3.1 <i>Stage I: appraising the challenge</i>	158
5.3.2 <i>Stage II: surveying the alternative actions available given the challenge</i>	164
5.3.3 <i>Stages III-IV: weighing alternatives and deliberation</i>	168
5.4 Evaluation and further extensions of the framework	169
5.5 Concluding remarks	173
References	174
<b>6 Learning, problem solving, and information research and development</b>	<b>176</b>
6.1 Introduction	176
6.2 Problem solving as mental model construction	178
6.3 The use of artificial intelligence (AI) and other problem-solving methods oriented to external information	184
6.4 Investment in information research and development for problem solving	187
6.5 Concluding remarks	197
References	197
<b>7 Policy space analysis: the choice of policies regarding arms expenditures and other issues and the value of information development</b>	<b>201</b>
7.1 Introduction	201
7.2 Some basic aspects of policy space analysis	203
7.2.1 <i>The traditional line case in two-dimensional policy space</i>	203
7.2.2 <i>Isotims and isodapanes in two-dimensional policy space</i>	207
7.3 Particular advantageous policy positions: lobby and related effects	209
7.4 Compromise points in policy space	212
7.5 Support (supply and market) area analysis in policy space	215
7.5.1 <i>The support price gradient</i>	216
7.5.2 <i>Scale effects: the support price margin line</i>	219
7.5.3 <i>The constituent's net price line</i>	220
7.5.4 <i>Scale effects and marginal productivity: the net price margin line</i>	223

7.6	Relocation of potential leaders: Hotelling-type analysis	226
7.7	Effects and value of information development	229
	7.7.1 <i>A search for the mode: gains and costs</i>	230
	7.7.2 <i>Determining the investment value of information</i>	233
	7.7.3 <i>Some complicating factors</i>	238
7.8	Concluding remarks	242
	Appendixes	244
	7.A <i>Some further policy space analysis</i>	244
	7.B <i>Further analysis of the election situation and information development</i>	248
	7.C <i>Technical materials on the value of information</i>	249
	References	252
<b>8</b>	<b>National security reasoning: the nature and effectiveness of political argument</b>	<b>255</b>
8.1	Introduction	255
8.2	Some general remarks pertaining to political argument	257
8.3	A practical set of basic elements for political argument	259
8.4	Comparability of basic elements in a political argument and in decision-making analysis	261
8.5	The outlines of two significant political arguments on no first use of nuclear weapons in the European theater	263
8.6	The complex data base requirement	265
8.7	Some major problems in constructing and evaluating more complex political arguments	271
	8.7.1 <i>Problems in determining and precisely stating consistent objectives</i>	271
	8.7.2 <i>Problems with regard to the choice and definition of basic concepts</i>	272
	8.7.3 <i>Problems with respect to presuppositions and related elements in the development of a political argument</i>	273
	8.7.4 <i>Problems with respect to the definition and sources of relevant knowledge</i>	275
	8.7.5 <i>Problems in using historical materials in particular and settling upon pertinent historical interpretation</i>	276
	8.7.6 <i>Problems in anticipating rebuttals and countering them</i>	279
	8.7.7 <i>Problems with regard to the use of insiders' knowledge</i>	281
8.8	Problems in developing justifications (warrants and backing) on a more involved level	281
8.9	Problems of dealing with possible worlds, succession of events and dynamics, and plans	284
8.10	Problems associated with learning phenomena, crisis situations, system effects, and multiple-target audiences (interest groups)	287

	<b>Contents</b>	xi
8.11	<b>Concluding remarks</b>	289
	<b>References</b>	291
<b>9</b>	<b>World system models: incorporation of military expenditures and arms trade</b>	295
9.1	Introduction	295
9.2	The Leontief World Input–Output (I–O) model	297
9.3	The social accounting framework	302
9.4	The interregional linear programming model	306
9.5	Multicountry computable general equilibrium (CGE) models and trade matrix projection	307
9.6	The translog function, the comparative cost approach, and trade flows	310
9.7	The potentials of the gravity model	311
9.8	The multimethod approach for trade projection and arms trade	313
9.9	The projection of military expenditures in the CGE, world econometric (LINK-type), and programming models	315
9.10	The GLOBUS model and potential developments	322
9.11	Concluding remarks	326
	<b>Appendixes: technical materials on multiregion general equilibrium models and use of the multimethod approach for construction of a trade matrix</b>	327
	9.A <i>The general interregional equilibrium model</i>	327
	9.B <i>A computable multiregion general equilibrium model</i>	328
	9.C <i>The use of the multimethod approach to trade matrix construction in CGE models</i>	330
	9.D <i>The use of the multimethod approach to trade matrix construction in the LINK model</i>	332
	<b>References</b>	333
<b>10</b>	<b>Negotiation/mediation principles and qualitative and quantitative conflict management procedures</b>	337
10.1	Introduction	337
10.2	Basic concepts and definitions	340
10.3	Conflict situation characteristics: identification of key characteristics for a given situation	341
10.4	Principles of negotiation (for a two-party conflict)	347
	10.4.1 <i>Principles for the preparation and analysis phase</i>	348
	10.4.2 <i>Principles for the proposal-making phase</i>	350

10.4.3	<i>Principles for the interaction phase (to reach agreement)</i>	352
10.4.4	<i>Principles for the final packaging phase: enhancement of implementability</i>	354
10.5	<b>Principles of mediation (for a two-party conflict)</b>	354
10.5.1	<i>Principles for the preparation and analysis phase</i>	355
10.5.2	<i>Principles for the interaction phase</i>	358
10.5.3	<i>Principles for the final packaging phase: enhancement of implementability</i>	360
10.6	<b>Instances of past applications of the selected principles of negotiation and mediation</b>	360
10.7	<b>Construction and illustration of qualitative conflict management procedures</b>	365
10.7.1	<i>The construction problem</i>	365
10.7.2	<i>Illustrations of qualitative conflict management procedures</i>	366
10.8	<b>Quantitative conflict management procedures: selection of a best or workable one</b>	368
10.9	<b>Concluding remarks</b>	378
	<b>References</b>	378
11	<b>Potential for a specific application: the U.S.-Soviet arms control conflict problem</b>	381
11.1	<b>Introduction</b>	381
11.2	<b>Key characteristics of the U.S.-Soviet conflict</b>	382
11.3	<b>Key aspects and properties of a CMP for the U.S.-Soviet conflict</b>	383
11.3.1	<i>Security, uncertainty, and restricted veto power</i>	383
11.3.2	<i>Limited or zero reliance on third-party intervention</i>	385
11.3.3	<i>Economic security maintenance and the use of models to generate essential economic information</i>	386
11.3.4	<i>Issue fractionation and logrolling for guaranteed improvement</i>	389
11.3.5	<i>The need for limited commitment</i>	391
11.3.6	<i>Balance-sheet and "issue-complex" analysis</i>	391
11.3.7	<i>Other useful aspects</i>	393
11.3.8	<i>Use of the time exploitation principle</i>	394
11.4	<b>Other basic aspects to which a CMP should be sensitive</b>	394
11.4.1	<i>Monitoring and inspection</i>	394
11.4.2	<i>Understanding enhancement and knowledge accumulation</i>	395
11.4.3	<i>Recognition of the play of personality and sociocultural factors</i>	396
11.4.4	<i>Continuous information research and development</i>	397
11.4.5	<i>Exploitation of the force of public opinion</i>	397

<b>Contents</b>	<b>xiii</b>
11.5 <b>Stability: an achievable property?</b>	<b>398</b>
11.6 <b>Some nonbasic factors</b>	<b>399</b>
11.7 <b>Concluding remarks</b>	<b>400</b>
<b>References</b>	<b>401</b>
<b>12 Summary of Part I and conclusions</b>	<b>402</b>
<b>Part II <i>Some advanced analyses</i></b>	<b>411</b>
<b>13 Synthesis of arms race models</b>	<b>413</b>
13.1 <b>Introduction</b>	<b>413</b>
13.2 <b>Synthesis: the Richardson side of the coin</b>	<b>414</b>
13.3 <b>Synthesis: the optimization side of the coin</b>	<b>423</b>
13.4 <b>Concluding remarks</b>	<b>437</b>
<b>References</b>	<b>438</b>
<b>14 Learning by a group, its leader, and its individual members</b>	<b>439</b>
14.1 <b>Introduction</b>	<b>439</b>
14.2 <b>A qualitative approach</b>	<b>440</b>
14.3 <b>Toward a quantitative approach with members only learning</b>	<b>446</b>
14.4 <b>Toward a quantitative approach with leader and members learning</b>	<b>459</b>
14.5 <b>Generalization to the hierarchical social system</b>	<b>461</b>
14.6 <b>Concluding remarks</b>	<b>463</b>
<b>Appendix: proof of "reasonable" convergence in model with leader and members learning</b>	<b>464</b>
<b>References</b>	<b>466</b>
<b>15 Information research and development from a dynamical system viewpoint</b>	<b>467</b>
15.1 <b>Introduction</b>	<b>467</b>
15.2 <b>A background static-type model</b>	<b>468</b>
15.3 <b>A dynamical systems learning model for the mediator</b>	<b>476</b>
15.4 <b>A dynamical systems learning model for a participant</b>	<b>480</b>
15.5 <b>Concluding remarks</b>	<b>482</b>
<b>References</b>	<b>482</b>
<b>16 Invention and innovation in information research and development for problem solving: an exploratory view</b>	<b>484</b>
16.1 <b>Introduction and general remarks</b>	<b>484</b>
16.2 <b>Basic variables and parameters in a two-equation (laws of change) model</b>	<b>487</b>



16.3	Need and demand for invention (new conflict management procedures, discussion frameworks, and so on): the $K$ factor	491
16.4	Communication (presentation) of need or demand: the $\xi$ factor	492
16.5	Invention, the production of creative ideas and scientific knowledge (basic research) and know-how (applied research or potential innovation): the $K$ factor	495
16.6	Communication (transmission and diffusion) of creative ideas and scientific knowledge and potential innovation to locations of possible use: the $l$ factor	498
16.7	Adoption and implementation	500
16.8	The role of policy	502
16.9	Conclusions	502
	References	504
	<i>Notation</i>	506
	<i>Author index</i>	511
	<i>Subject index</i>	516